

(PCT Rule 61.2)

To:

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1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

03 May 2001 (03.05.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
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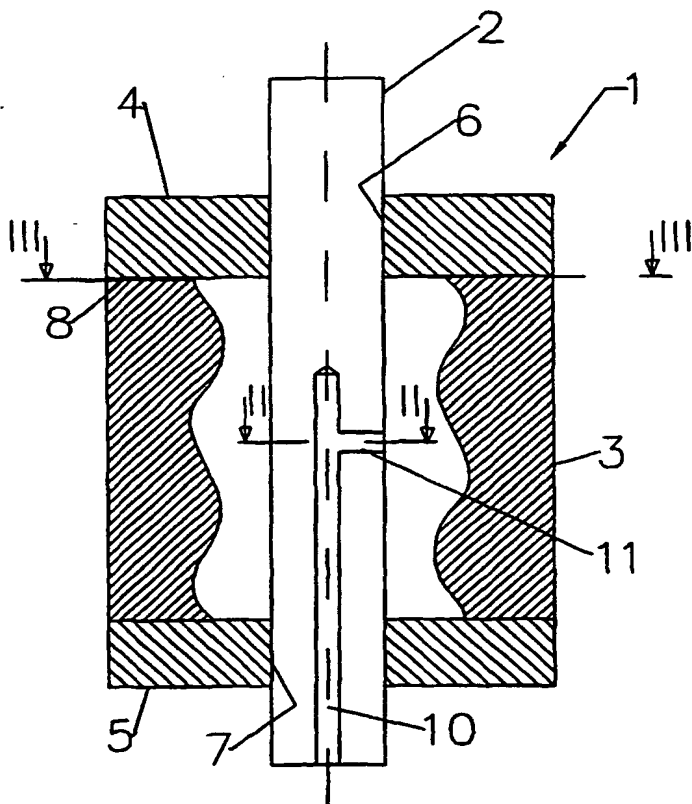
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*For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.*

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(54) Title: METHOD FOR PRODUCING POLYMER ROTORS



(57) Abstract: The invention relates to a method of manufacturing a rotor (12) for a helical screw machine that includes a metal shaft (2) and helical lobes (9) mutually separated by intermediate grooves (13), comprising the steps of providing the shaft (2) with a blind axially extending passageway (10); connecting the passageway (10) with the barrel surface of the shaft (2) by means of at least one channel (11) extending outwardly from the shaft; inserting the rotor shaft (2) in a mould (1) that includes two mutually spaced end-walls (4, 5) which have respective rotor shaft receiving openings (6 and 7), said openings (4, 5) embracing the rotor shaft (2, 19) at least in a generally sealing fashion; heating the mould (1) and the shaft (2) on the curing temperature of the polymer; delivering polymer-forming materials to the mould (1); maintaining the barrel wall (3) of the mould (1) at said curing temperature until the polymer has cured; and removing the rotor from the mould (1). The method is characterised by the further steps of disposing the outwardly extending channel (11) on the shaft (2) such that said channel will be located generally in the middle of the mould (1) when the shaft (2) is inserted therein; and pressing the polymer into the axially extending passageway (10) at an overpressure of at least 1 bar.

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METHOD FOR PRODUCING POLYMER ROTORS

The present invention relates to a method of manufacturing a polymeric rotor that includes a metal shaft having anchored thereon a polymeric body with helical lobes
5 mutually separated by intermediate grooves, for a helical screw machine, such as a helical screw compressor and helical screw expander.

Rotors for helical screw machines include a metal shaft that has a rotor body affixed thereto. This rotor body has helical lobes mutually separated by grooves. Metal rotors are conventionally produced in one piece, whereas polymeric rotors have a metal
10 shaft to which there is affixed a polymeric rotor body. The rotor body has at least two lobes, normally 4-7 lobes. A helical rotor machine will normally includes two mutually co-acting rotors, of which one rotor is a male rotor with typically relatively strong lobes, and the other rotor is a female rotor which normally has relatively weaker lobes. The rotor body surrounding the metal shaft is a coherent body in which the grooves
15 separating the lobes have only a small material thickness, particularly in respect of a female rotor.

DE-A1-39 03 067 teaches the manufacture of a rotor for helical screw machines. According to this publication, a metal shaft is placed vertically in an open top matrix, whereafter a liquid polymer is either delivered to the outside of the shaft or through a
20 passageway in the centre of the shaft, wherein channels extend radially to the shaft periphery from the lower end of the passageway. These channels open into the matrix at the lower end of the cavity to be filled with the liquid polymeric material. It is stated in the publication that this latter alternative is to be preferred when casting female rotors, that is to say female rotor bodies, of small thickness in the grooves between the lobes of
25 the rotor. These radially extending channels open into the lower part of the cavity that has the smallest outer diameter.

When the polymer is delivered through the central passageway in the metal shaft in accordance with this publication, it is necessary that the polymer remains liquid in the lower part of the mould throughout the time taken to fill the mould completely. It is not
30 until this has been achieved that conditions can be applied which cause the polymer to transform to a solid state in the lower part of the mould.

It has been found that rotors produced in this way have a smaller diameter in the centre of the rotor than at the ends thereof. The contraction or shrinkage that results in this hourglass shape may be due to the solidification of the polymer at a lower

temperature at the ends of the rotor than at its centre. The higher temperature in the centre of the rotor results in more pronounced shrinkage.

An object is to provide a method of manufacture that eliminates the drawbacks associated with the known method and therewith obtain rotors that do not have a waisted
5 centre part in an axial direction.

In accordance with the present invention, a polymeric rotor for a helical screw machine that includes a metal shaft and at least two helical lobes mutually separated by intermediate grooves is manufactured by providing the shaft with an axially extending blind passageway, connecting the axially extending passageway with the barrel surface
10 of the shaft by means of at least one radially extending channel, inserting the metal shaft in a mould comprising two mutually spaced end walls that include mutually opposed central openings that receive the rotor shaft, said openings sealingly enclosing the metal shaft at least generally, heating the mould and the metal shaft to the polymer curing temperature, delivering polymer-forming materials to the mould, maintaining the mould
15 and the metal shaft at said curing temperature until the polymer has been cured, and then removing the metal shaft with rotor from the mould. The inventive method is characterised in that the radial channel extending outwards from the passageway is arranged in a manner such that said channel will be situated generally in the middle of the mould when the shaft is inserted thereinto, and in that the polymer is pressed into the
20 axially extending passageway at an overpressure of at least 1 bar.

Preferred embodiments of the method will be apparent from the dependent Claims. The polymer material, release agent, and filler may be those described in the German reference or other materials known to the person skilled in this art.

According to one preferred embodiment of the invention, the metal shaft includes
25 helical recesses or grooves that are filled with polymeric material and that form a sunken part of the outwardly lying lobe. The recesses or grooves will preferably have a parallel trapezium cross-section, with the shorter of the parallel sides located nearest the shaft periphery and extending perpendicularly to the shaft radius. The corners at the transition from the non-parallel sides to the shaft periphery are rounded, to reduce the fracture
30 tendency of the polymeric material.

The helical grooves may extend along the full length of the lobe or solely along a part thereof. Similarly, the helical grooves may be two or more along part-grooves disposed along the same helical line. In this latter case, it is preferred that an outwardly directed channel opens into each part-groove.

According to the invention, the term metal alloys includes, for instance, steel and brass, wherewith steel is particularly preferred. The polymeric material may be polyurethane containing inorganic filler, for instance silicate-containing fibres.

The invention will now be described by way of example and with reference to the accompanying drawing, in which

Figure 1 is a schematic longitudinal section view of a mould according to the invention and shows a metal shaft inserted in the mould;

Figure 2 is a sectional view of the metal shaft, taken on the line II-II in Figure 1;

Figure 3 is a sectional view of a first form of a known rotor end profile, taken on the line III-III in Figure 1;

Figure 4 is a sectional view of a second embodiment of a rotor end profile, taken on the line III-III in Figure 1; and

Figure 5 is a schematic vertical sectional view of a static mixer.

Figure 1 shows a mould 1 in which a metal shaft, preferably a steel shaft 2, is inserted. The barrel wall 3 of the mould 1 has a cylindrical outer surface and internally the outer contour of a helical rotor, which in the illustrated case includes five lobes and an equal number of intermediate grooves, as shown in Figure 3. The mould 1 includes an upper circular end-wall 4 and a lower circular end-wall 5. Each of the end-walls 4, 5 is provided with a respective central, shaft-receiving opening 6 and 7. The openings 6, 7 embrace the rotor shaft 2, such as to at least generally seal against said shaft. The mould 1 includes in the upper part of the barrel wall 3 an air vent 8 for each rotor lobe 9, as will be seen from Figure 3. These air vents 8 may also be disposed as grooves in the upper end-wall 4.

The rotor shaft 2 has at its lower end a central, axially extending passageway 10 that extends more than half way into the shaft 2. As will be seen from Figure 1, those end-parts of the shaft 2 that are located outside the end-walls 4, 5 are of equal lengths. If the shaft 2 is placed asymmetrically in the mould 1, the length of the axial passageway 10 will extend beyond the centre of the mould 1 surrounding the shaft.

At least one radial channel 11 extends to the periphery of the shaft 2 from the passageway 10. The number of radial channels 11 extending from the axial passageway 10 to the periphery of the shaft will preferably equal the number of lobes 9 to be provided on the rotor. These radial channels 11 are preferably offset relative to each other in the axial direction of the shaft, so as to reduce or minimise weakening of the shaft in the region of said channels 11.

Figure 2 shows the shaft 2 and one such radial channel 11 and two further channels 11' and 11'' shown in broken lines, these further channels being located beneath the surface of the section. Although not shown, the shaft includes a further two radial channels 11 above the section surface.

5 Figure 3 illustrates an end section of a male rotor 12 that has five lobes 9. These lobes 9 are mutually separated by grooves 13. It will be apparent from this Figure that the mould has five air vents 8 in its upper part.

Figure 4 is an end section of a female rotor 14 that has six lobes 15 and six intermediate grooves 16, said rotor being inserted in a mould 17. The rotor is formed in accordance with the invention. The rotor body 14 is disposed on a steel shaft 19 and has the form of six individual and mutually separated lobes 15. It will be seen from the Figure that the bottoms of respective grooves 16 between the lobes 15 are formed by the steel shaft 19. The lobes 15 are thus not mutually connected by polymeric material as in the case of the lobes 9 of the male rotor shown in Figure 3. The mould includes six air vents 18. The rotors produced in accordance with Figures 3 and 4 are not intended to interact with each other.

As will be seen from Figure 4, the shaft 19 includes recesses 20 that are trapezoidal in cross-section, wherewith the longer of the mutually parallel surfaces face towards the centre point of the shaft 19. The non-parallel surfaces have rounded corners at the shaft periphery. These trapezoidal recesses 20 widen in the same helical shape as the outwardly lying lobe 15. In one preferred embodiment of the invention, each radial channel 11 (Figure 2) opens into one such recess 20. The recesses 20 widen from the radial channel 11 over a longer or shorter distance. In the case of the embodiment shown in Figure 4, the recess 20 has the same length as the lobe 15. These recesses 20 are effective in the affixment of the polymer in the shaft 19. The rounded corners at the periphery of the shaft 19 reduce the risk of crack formation and lengthen the useful life of the rotor.

Figure 5 is a schematic vertical sectional view of a static mixer 30 for use in moulding inventive polymeric rotors. The mixer 30 includes a first conduit 31 that has two inlet openings 33, 34 at respective ends thereof. A third opening 35 that connects with one end of a second conduit 32 is provided in the conduit wall between said openings 33, 34. This second conduit includes a number of mixing elements 36, which may be helically shaped. The elements 36 are arranged to prevent material passing

axially through the second conduit 32 without mixing. Such static mixers are known to the art.

According to the invention, a liquid or solid polymeric material, e.g. polyurethane, preferably containing filler, is delivered to the axially extending, central passageway 10 at a temperature of about 30°C and at an overpressure of at least about 1 bar and at most about 15 bar. The preferred pressure lies about midway of this pressure range. The mould 1 and the shaft 2 have been heated to a temperature of about 90°C. A release agent may have been applied to the inner surface of the mould 1 prior to delivering the polymeric material. The barrel 3 of the mould is also heated electrically so as to maintain a temperature of about 90°C, this being done conventionally. The shaft 2 and the end-walls 4, 5 of the mould have a high thermal capacity and are therefore not heated. The polymeric material delivered to the axially extending passageway 10 leaves said passageway through the radially disposed channels 11.

The material exiting from the radial channels 11 first flows down in the upstanding mould 1 and thereafter rises in the mould cavity until the mould has been filled. Because the material delivered has a much lower temperature than the shaft 2 and the mould 1, the material will take up heat as it is delivered, while cooling the shaft 2 and the non-heated end surfaces. Because the material is delivered centrally in the mould 1, the material will be located where the lowest temperature prevails at the beginning of the solidification process. The fact that the material is delivered under a relatively high overpressure in precisely the centre of the mould 1, shrinkage of the polymer, normally occurring in the centre, is compensated for so that the rotor will not have a smaller diameter in the midway zone of the rotor than the diameter of the ends of the rotor.

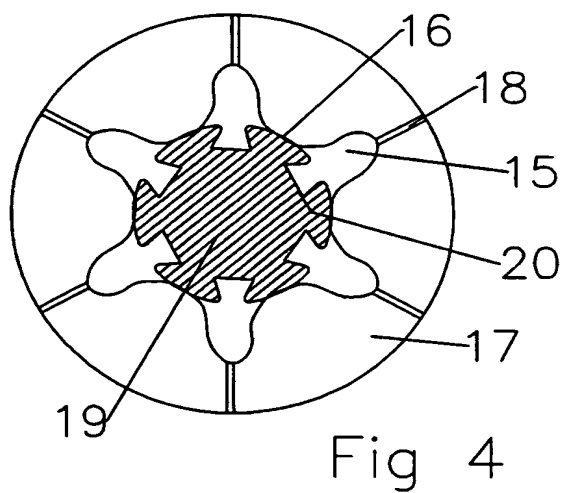
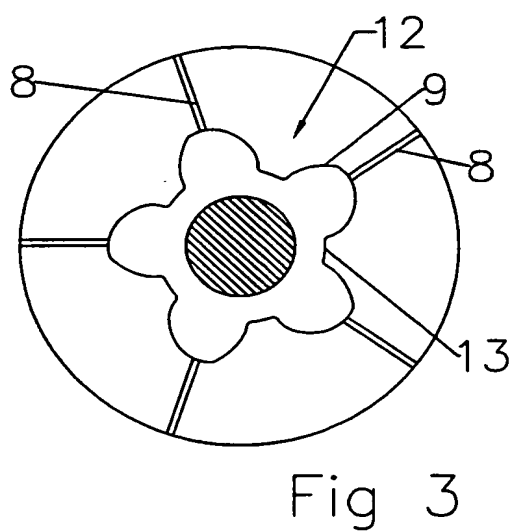
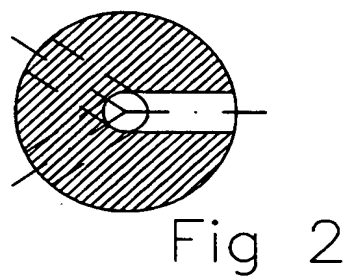
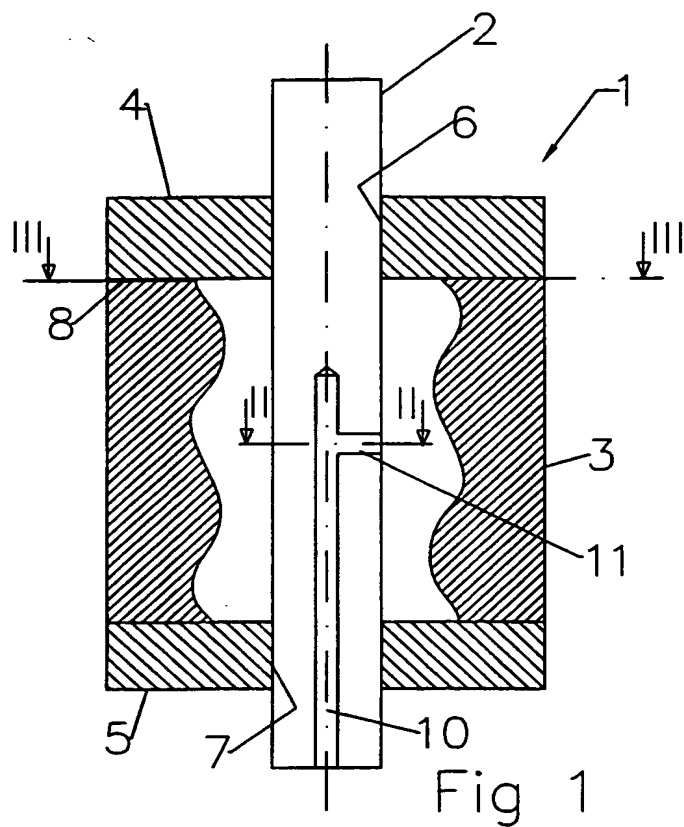
According to a second embodiment of the invention, a static mixer 30 is placed in the central passageway 10. The length of the second conduit 32 of the static mixer is such that when the mixer is inserted it will only reach as far as the radially extending channels that lie nearest the orifice of the central passageway. This enables two components that together form the polymer after being cured to be delivered through a respective opening 33, 34 of the static mixer 30, said components passing through the opening 35 and into the second conduit 32 of the mixer. The components are mixed in the second conduit with the aid of the mixing elements 36, which induce lateral movement of the material.

CLAIMS

1. A method of manufacturing a rotor (12, 14) for a helical screw machine that includes a metal shaft (2, 19) and helical lobes (9, 15) mutually separated by intermediate grooves (13, 16), comprising the steps of
- providing the shaft (2, 19) with a blind axially extending passageway (10);
 - connecting the passageway (10) with the barrel surface of the shaft (2, 19) by means of at least one channel (11);
 - inserting the rotor shaft (2, 19) in a mould (1) that includes two mutually spaced end-walls (4, 5) that include respective rotor shaft receiving openings (6 and 7), said openings (4, 5) embracing the rotor shaft (2, 19) at least in a generally sealing fashion;
 - heating the mould (1) and the shaft (2, 19) to the curing temperature of the polymer;
 - delivering polymer-forming materials to the mould (1);
 - maintaining the barrel wall (3) of the mould (1) at said curing temperature until the polymer has cured; and
 - removing the rotor from the mould (1),
- characterised** by the further steps of disposing the outwardly extending channel (11) on the shaft (2, 19) such that said channels will be located generally in the middle of the mould (1) when the shaft (2, 19) is inserted therein; and pressing the polymer into the axially extending passageway (10) at an overpressure of at least 1 bar.
2. A method according to Claim 1, **characterised** by providing the rotor shaft (2, 19) with a radially extending channel (11) for each lobe (9, 15), wherewith the channels (11) are disposed symmetrically around the circumference of the shaft.
3. A method according to Claim 2, **characterised** in that the channels (11) are offset relative to each other in the axial direction of the rotor shaft (2, 19).
4. A method according to Claim 2 or 3, **characterised** by positioning the shaft (2, 19) in the mould (1) such that an outwardly directed channel (11) opens into each lobe (9, 15).

5. A method according to Claim 2 or 3, **characterised** by providing the rotor shaft (2, 19) with helical recesses (20) that have the same helical form as the lobes (9, 15) and that each intersect a respective channel (11).
- 5 6. A method according to Claim 4, **characterised** by mixing the material in the axially extending passageway (10).
- 10 7. A method according to Claim 1, **characterised** by placing a static mixer (30) in the central passageway (10) and feeding a polymer-forming component through the opening (33) of the mixer, and feeding a further polymer-forming component through the other opening (34).

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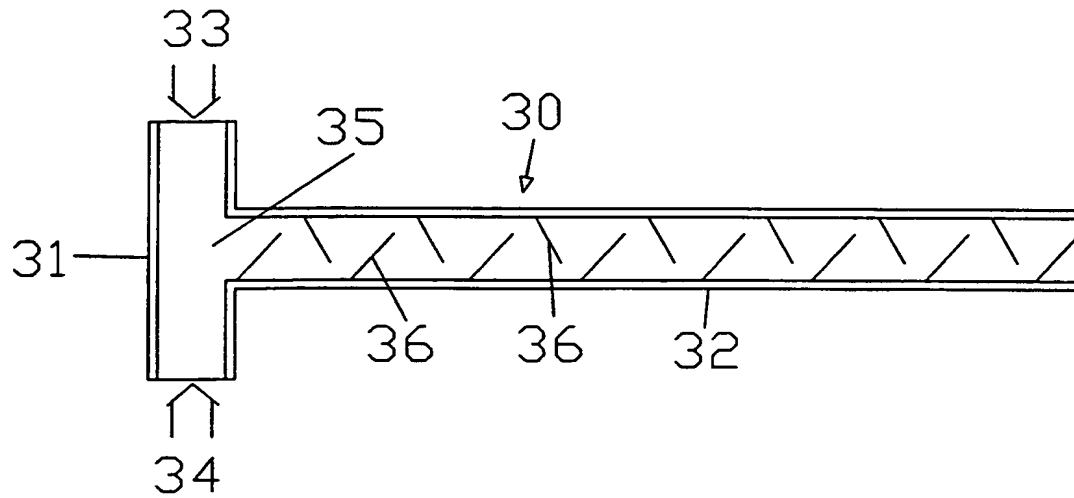


Fig 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01998

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B29C 39/10, F04C 18/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B29C, F04C, B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3903067 A1 (GVM GESELLSCHAFT FÜR SCHRAUBENVERDICHTER- UND SCHRAUBENMOTORENTECHNOLOGIE MBH), 9 August 1990 (09.08.90), figures 1,2, claims 1,2, abstract --	1-7
A	WO 9304811 A1 (OPCON AUTOROTOR AB), 18 March 1993 (18.03.93), figures 1-5, claim 1, abstract --	1-7
A	WO 8909881 A1 (SVENSKA ROTOR MASKINER AB), 19 October 1989 (19.10.89), figure 1, claim 1, abstract --	1-7

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 January 2001

Date of mailing of the international search report

02-02-2001

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01998

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 503730 C2 (SVENSKA ROTOR MASKINER AB), 12 August 1996 (12.08.96), figure 1, claim 1, abstract -- -----	1-7

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/SE 00/01998

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	3903067	A1	09/08/90	NONE	
WO	9304811	A1	18/03/93	DE 69206624 D,T EP 0602143 A,B JP 6510353 T SE 502265 C SE 9102530 A	25/07/96 22/06/94 17/11/94 25/09/95 04/03/93
WO	8909881	A1	19/10/89	DE 68907054 D,T EP 0411000 A,B JP 2833808 B JP 3503667 T SE 463040 B,C SE 8801276 A US 5219499 A	18/11/93 06/02/91 09/12/98 15/08/91 01/10/90 08/10/89 15/06/93
SE	503730	C2	12/08/96	SE 9403303 A	31/03/96

PCT REQUEST

1313 ME

Original (for SUBMISSION) - printed on 16.10.2000 09:15:50 AM

0	For receiving Office use only	
0-1	International Application No.	PCT/SE 00 / 0 1 9 9 8
0-2	International Filing Date	16 -10- 2000
0-3	Name of receiving Office and "PCT International Application"	The Swedish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.91 (updated 10.10.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Swedish Patent Office (RO/SE)
0-7	Applicant's or agent's file reference	1313 ME
I	Title of invention	METHOD FOR PRODUCING POLYMER ROTORS
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	SVENSKA ROTOR MASKINER AB
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III-1-6	State of nationality	SE
III-1-7	State of residence	SE

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2/3

PCT REQUEST

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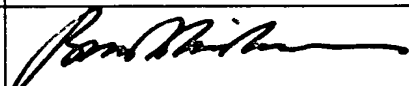
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III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	TIMUSKA, Karlis
III-2-5	Address:	Valhallavägen 16 S-114 22 Stockholm Sweden
III-2-6	State of nationality	SE
III-2-7	State of residence	SE
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name (LAST, First)	WIEDEMANN, Bernd
IV-1-2	Address:	SVENSKA ROTOR MASKINER AB Box 15085 S-104 65 Stockholm Sweden
IV-1-3	Telephone No.	+46 8 466 45 19
IV-1-4	Facsimile No.	+46 8 466 45 01
IV-1-5	e-mail	bw@rotor.se
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	JP KR US
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	18 October 1999 (18.10.1999)
VI-1-2	Number	9903772-3
VI-1-3	Country	SE

PCT REQUEST

1313 ME

Original (for SUBMISSION) - printed on 16.10.2000 09:15:50 AM

VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VII-2	Request to use results of earlier search; reference to that search		
VII-2-1	Date	18 October 1999 (18.10.1999)	
VII-2-2	Number	9903772-3	
VII-2-3	Country (or regional Office)	SE	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	3 ✓	-
VIII-2	Description	5 ✓	-
VIII-3	Claims	2 ✓	-
VIII-4	Abstract	1 ✓	1313_m_pans_wo_se_00 abst_txt.txt
VIII-5	Drawings	2 ✓	-
VIII-7	TOTAL	13 ✓	
VIII-8	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	Figure of the drawings which should accompany the abstract	1	
VIII-19	Language of filing of the international application	Swedish	
IX-1	Signature of applicant or agent		
IX-1-1	Name (LAST, First)	WIEDEMANN, Bernd	

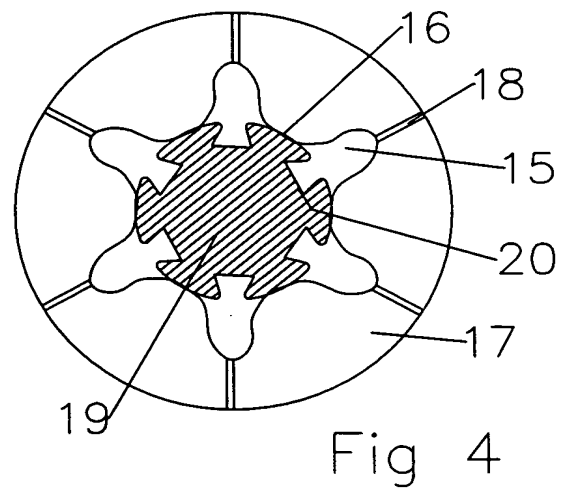
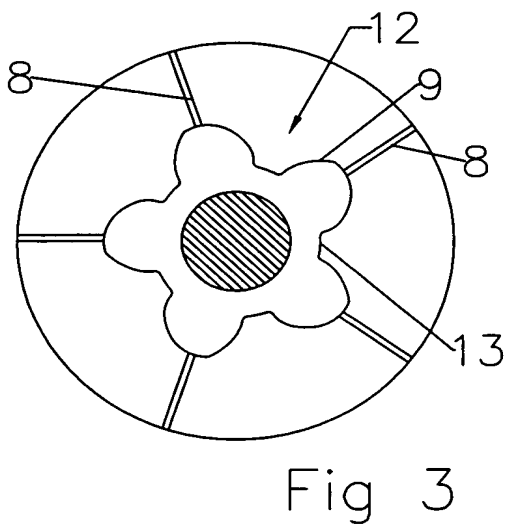
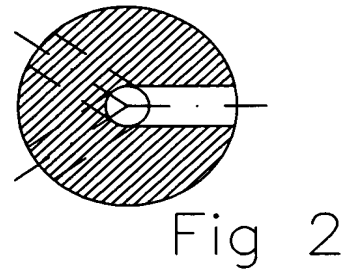
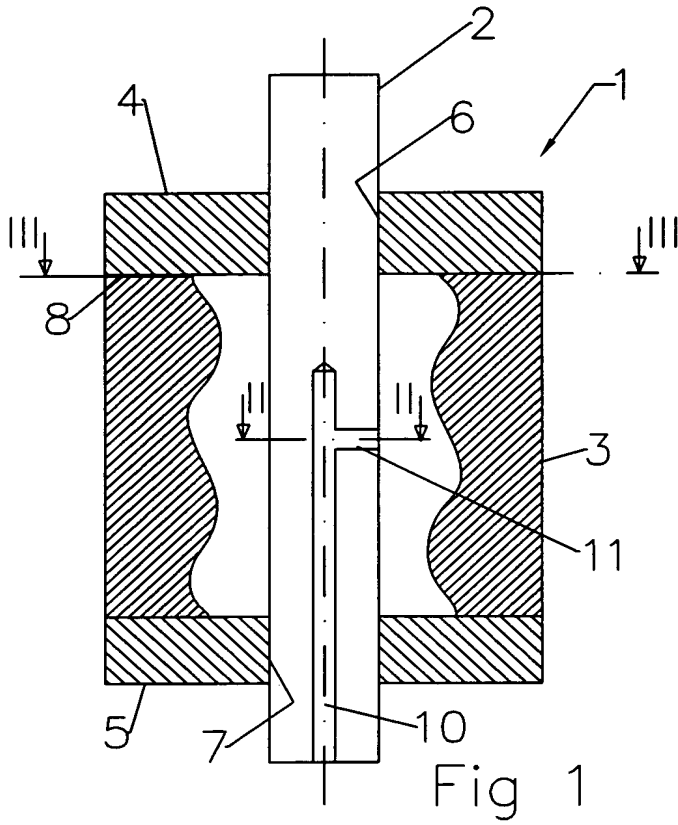
FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	1 6 -10- 2000
10-2	Drawings:	
10-2-1	Received X	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the received copy by the International Bureau	1 6 NOVEMBER 2000	1 6 NOV 2000
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1/2



2/2

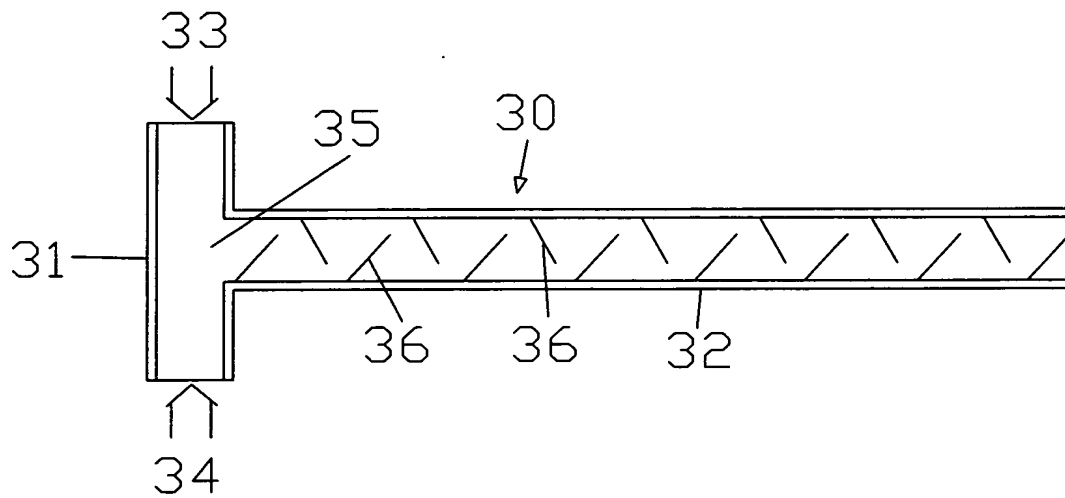


Fig 5

Sätt att framställa polymerrotorer

Föreliggande uppfinning avser ett sätt att framställa en polymerrotor innefattande en metallaxel med en på denna förankrad polymerkropp med helixformade lober åtskilda av mellanliggande spår för en skruvrotormaskin, såsom skruvrotorkompressor och skruv-
5 rotorexpander.

Rotorer för skruvrotormaskiner uppvisar en metallaxel och en med denna fast förbunden rotorkropp med helixformade lober och dessa lober åtskiljande spår. Metallrotorer är vanligen framställda i ett stycke medan polymerrotorer uppvisar en metallaxel, på vilken en rotorkropp av polymer är förankrad. Rotorkroppen har minst två lober och
10 vanligen 4 – 7 lober. I en skruvrotormaskin samverkar vanligen två rotor, av vilka den ena är en hanrotor med vanligen relativt kraftiga lober och den andra en honrotor med vanligen relativt veka lober. Rotorkroppen, som omger metallaxeln, är en sammanhängande kropp, i vilken de loberna åtskiljande spåren har en ringa materialtjocklek, i synnerhet i en honrotor.

Genom DE-A1-39 03 067 är det känt att framställa en rotor för en skruvrotormaskin. Enligt denna skrift framställer man en upptill öppen matris, i vilken man placerar en metallaxel lodrätt och tillför en flytande polymer till antingen axelns utsida eller genom en kanal i axelns mitt, vilken kanal i sin nedre ände uppvisar radiella kanaler till axelns
20 periferi. Dessa kanaler mynnar i matrisen i den undre änden av det rum, som skall fyllas med det flytande polymermaterialet. Enligt denna hänvisning är det senare alternativet att föredra när man gjuter honrotorer, dvs honrotorkroppar, med ringa tjocklek i spåren mellan rotorns lober. De radiella kanalerna mynnar i den nedre delen av formrummet med den minsta ytterdiametern.

Vid tillförsel av polymeren genom den centrala kanalen av metallaxeln enligt
25 denna hänvisning måste polymeren vara flytande i den nedre delen av formen under hela den tid det tar att fylla hela formen. Först därefter kan man åstadkomma sådana betingelser att polymeren övergår till fast form i den nedre delen.

Det har visat sig att på detta sätt framställda rotor uppvisar en mindre diameter i mitten än vid ändarna av rotorn. Denna krympning, som leder till så kallad timglasform, kan bero på att polymeren stelnar vid en lägre temperatur vid ändarna än i mitten av ro-
30 torn. Den högre temperaturen i mitten leder till en större krympning.

Syftet med föreliggande uppfinning är att anvisa ett framställningssätt, vid vilket man undanröjer de nackdelar, som är förbundna med det kända sättet, för att erhålla polymerrotorer, som ej uppvisar en midja i sin axiella mittdel.

Enligt uppfinningen framställer man en polymerrotor för en skruvrotormaskin med en metallaxel och helixformade, av mellanliggande spår åtskilda, lober, genom att man förser axeln med en, endast i sin ena ände öppen, axiell borrning, förbinder den axiella borrningen med axelns mantelyta medelst minst en kanal, inför rotoraxeln i en gjutform med två på avstånd från varandra anordnade ändväggar, som är försedda med centrala öppningar för mottagning av rotoraxeln, vilka öppningar åtminstone i huvudsak tätande omsluter rotoraxeln, värmer gjutformen inklusive axeln till härdningstemperatur för polymeren, tillför polymerbildande material till gjutformen, håller gjutformens mantelvägg vid härdningstemperaturen tills polymeren har härdat och avlägsnar rotorn ur gjutformen. Det utmärkande för sättet är att man anordnar den från borrningen utåtriktade kanalen så på rotoraxeln, att den befinner sig huvudsakligen i mitten av gjutformen, när axeln är införd i denna och att man med ett övertryck av minst 1 bar pressar polymeren in i den axiella borrningen.

Föredragna utföringsformer enligt föreliggande sätt framgår av de beroende kraven. Polymermaterialet liksom släppmedel och fyllmedel kan vara de som är beskrivna i den tyska hänvisningen eller andra för fackmannen kända material.

Enligt en föredragen utföringsform uppvisar metallaxeln helixformade urtagningar eller spår, som är fyllda med polymermaterial och utgör en försänkt del av den utanför liggande loben. Urtagningarnas eller spårens tvärsnitt har företrädesvis formen av en parallelltrapets, varvid den kortare av de parallella sidorna befinner sig närmast axeln periferi och är vinkelrät mot axelns radie. För minskning av brottbenägenheten hos polymermaterialet är hörnen i övergången från de icke-parallella sidorna till axelns periferi rundade.

De helixformade spåren kan utbreda sig utmed lobens hela längd eller endast en del därav. Likaså kan de helixformade spåren vara två eller flera efter varandra utmed samma helixlinje anordnade delspår. Därvid är det föredraget, att en utåtriktad kanal mynnar i varje delspår.

Enligt uppfinningen innefattar termen metall legeringar, såsom exempelvis stål och mässing, varvid stål är speciellt föredraget. Polymermaterialet kan exempelvis vara polyuretan innehållande oorganiskt fyllmedel, exempelvis silikathaltiga fibrer.

Uppfinningen kommer nu att beskrivas med hjälp av en utföringsform och med hjälp av ritningen, på vilken

Figur 1 visar schematiskt ett längdsnitt genom föreliggande gjutform med införd metallaxel;

Figur 2 visar ett snitt utmed linjen II - II i figur 1 genom metallaxeln;

Figur 3 visar ett snitt utmed linjen III - III i figur 1 med en första form av en känd rotorändprofil;

Figur 4 visar ett snitt motsvarande snittet III - III i figur 1 med en andra utförings-
5 form av en rotorändprofil; och

Figur 5 visar schematiskt ett vertikalsnitt genom en statisk blandare.

Figur 1 visar en gjutform 1, i vilken en metallaxel, företrädesvis en stålaxel 2 är
införd. Formens 1 mantelvägg 3 har en cylindrisk utsida och invändigt yttre konturen av
en helixformad rotor, som enligt denna utföringsform har fem lober och lika många mel-
10 lanliggande spår, vilket framgår av figur 3. Vidare uppvisar formen 1 en övre cirkulär
ändvägg 4 och en undre cirkulär ändvägg 4. Dessa ändväggar 4, 5 är försedda med var
sin central öppning 6 respektive 7 för mottagning av rotoraxeln 2. Dessa öppningar 6, 7
omsluter rotoraxeln 2 åtminstone i huvudsak tätande. Gjutformen 1 uppvisar i den övre
delen av mantelväggen 3 en avluftningskanal 8 för varje rotorlob 9 såsom framgår av
15 figur 3. Dessa avluftningskanaler 8 kan även vara anordnade såsom spår i den övre änd-
väggen 4.

Rotoraxeln 2 uppvisar i sin nedre del en central axiell kanal 10, som sträcker sig
längre än halvvägs in i axeln 2. Axeln 2 ändpartier, som befinner sig utanför ändväggar-
na 4 och 5 är lika långa, såsom framgår av figur 1. Om axeln 2 är asymmetriskt placerad i
20 formen 1 har den axiella kanalen 10 en sådan längd, att den når längre än till mitten av
den axeln omgivande formen 1.

Från kanalen 10 utgår minst en radiell kanal 11 till axeln 2 periferi. Företrädesvis
utgår lika många radiella kanaler 11 från axiella kanalen 10 mot periferin av axeln som
antalet lober 9 i rotorn som skall framställas. Dessa radiella kanaler 11 är företrädesvis
25 förskjutna i axiellt led för att minska försvagningen av axeln i området för de radiella
kanalerna 11.

I figur 2 visas axeln 2 med en sådan radiell kanal 11 och med streckade linjer är
två andra kanaler 11' och 11'' antydda, vilka ligger under snittytan. Ytterligare två radi-
ella kanaler 11 finns över snittytan men är ej visade.

Figur 3 visar en ändsektion av en hanrotor 12 med fem lober 9. Mellan dessa lo-
ber finns fem loberna 9 åtskiljande spår 13. Av denna figur framgår, att formen i sin övre
del har fem avluftningskanaler 8.

Figur 4 visar en ändsektion av en honrotor 14 med sex lober 15 och likaledes sex
mellanliggande spår 16 insatta i en gjutform 17. Denna rotor är utformad i enlighet med

uppfinningen. Rotorkroppen 14, som är anordnad på en stålaxel 19, har formen av sex separata, åtskilda lobar 15. Av figuren framgår, att de mellan loberna 15 bildade spårens 16 botten utgöres av stålaxeln 19. Loberna 15 är således ej förbundna med varandra av polymermaterial, såsom är fallet med hanrotorns lobar 9 i figur 3. I gjutformen finns sex
5 avluftningskanaler 18. De enligt figur 3 och 4 framställda rotorerna är ej avsedda att samverka med varandra.

Av figur 4 framgår vidare, axeln 19 är försedd med i tvärsnitt trapetsformade urtagningar 20, varvid den längre av de inbördes parallella ytorna vetter mot axelns 19 mittpunkt. De icke parallella ytorna har avrundade hörn mot axelns 19 periferi. Dessa
10 trapetsformade urtagningar 20 utbreder sig i samma helixform som den utanför liggande loben 15. Varje radiell kanal 11 (figur 2) mynnar i en sådan urtagning 20 enligt en föredragen utföringsform. Urtagningarna 20 utbreder sig från den radiella kanalen 11 en längre eller kortare sträcka. Enligt den i figur 4 visade utföringsformen har urtagningen 20 samma längd som loben 15. Dessa urtagningar 20 förankrar polymeren i axeln 19. De
15 rundade hörnen i axelns 19 periferi minskar risken för sprickbildning och förlänger rotorns livslängd.

Figur 5 visar schematiskt ett vertikalsnitt genom en statisk blandare 30 för användning för gjutning av föreliggande polymerrotor. Denna blandare 30 innefattar ett första rör 31 med två inloppsöppningar 33, 34 i ändarna. I rörväggen mellan öppningarna
20 33, 34 finns en tredje öppning 35, som är ansluten till en ände av ett andra rör 32. I detta andra rör finns ett antal blandningselement 36, som kan vara helixformade. Dessa element 36 är anordnade för att förhindra ren axiell rörelse genom den andra röret 32. Sådana statiska blandare är kända.

Enligt föreliggande sätt tillförs flytande eller fast polymer, t ex polyuretan, föredragesvis innehållande fyllmedel med en temperatur av ca 30° C till den axiella centrala kanalen 10 med ett övertryck av minst cirka 1 bar och högst av cirka 15 bar. Det föredragna trycket ligger cirka i mitten av detta intervall. Gjutformen 1 liksom axeln 2 har värmts till en temperatur av ca 90° C. Ett släppmedel kan ha anbringats på gjutformens 1 insida före tillförseln av polymeren. Dessutom värmer man manteln 3 elektriskt under
30 tillförseln av polymermaterial, så att man upprätthåller temperaturen på ca 90° C, vilket sker på känt sätt. Axeln 2, som har en stor värmekapacitet, liksom formens i ändväggar 4, 5 värms då ej. Detta till den axiella kanalen 10 förda materialet lämnar den centrala axiella kanalen 10 genom de radiellt anordnade radiella kanalerna 11.

- Materialet, som lämnar de radiella kanalerna 11 flyter först nedåt i den stående formen 1. Det tillförda materialet fyller sedan formens kavitet uppåt tills den är fylld. Genom att det tillförda materialet har en betydligt lägre temperatur än axeln 2 och formen 1 värms det vid tillförseln medan axeln 2 och de icke värmda ändytorna kylls. Genom att materialet tillförs i mitten av formen 1 har man där den lägsta temperaturen i början av stelningsprocessen. På grund av att man tillför materialet under ett relativt stort övertryck just i mittdelen av formen 1 kompenserar man för den i mitten vanligen åstadkomna krympningen av polymeren, så att man slipper erhålla en rotor med mindre diameter i rotorns mittzon.
- Enligt en annan utföringsform införes en statiska blandare 30 i centrala kanalen 10. Därvid har det andra röret 32 av den statiska blandaren en sådan längd, att den i infört läge endast når fram till den av de radiella kanalerna , som ligger närmast den centrala kanalens 10 öppning. Därvid kan två komponenter, som tillsammans efter härdning bildar polymeren tillföras genom var sin öppning 33, 34 av den statiska blandaren 30, varvid de passerar genom öppningen 35 in i det andra röret 32 av blandaren. I det andra röret blandas komponenterna med hjälp av blandningselementen 36 genom att dessa inducerar en lateral rörelse av materialet.

Patentkrav

1. Sätt att framställa en polymerrotor (12, 14) för en skruvrotormaskin med en metallaxel (2, 19) och helixformade, av mellanliggande spår (13, 16) åtskilda, lober (9, 15), varvid man

5 förser axeln (2, 19) med en, endast i sin ena ände öppen, axiell borrning (10),
förbinder den axiella borrningen (10) med axelns (2, 19) mantelyta medelst minst en kanal (11),

inför rotoraxeln (2, 19) i en gjutform (1) med två på avstånd från varandra anordnade ändväggar (4, 5), som är försedda med centrala öppningar (6 respektive 7) för mottagning av rotoraxeln (2, 19), vilka öppningar (4, 5) åtminstone i huvudsak tätande omsluter rotoraxeln (2),

värmer gjutformen (1) inklusive axeln (2, 19) till härdningstemperatur för polymeren,

tillför polymerbildande material till gjutformen (1),

15 håller gjutformens (1) mantelvägg (3) vid härdningstemperaturen tills polymeren har härdat och

avlägsnar rotorn ur gjutformen (1),

kännetecknat därav, att man anordnar den från borrningen utåtriktade kanalen (11) så på rotoraxeln (2, 19), att den befinner sig huvudsakligen i mitten av gjutformen (1), när axeln (2, 19) är införd i denna och att man med ett övertryck av minst 1 bar pressar polymeren in i den axiella borrningen (10).

2. Sätt enligt krav 1, kännetecknat därav, att man förser rotoraxeln (2, 19) med en utåtriktad (11) kanal för varje lob (9, 15), varvid kanalerna (11) anordnas symmetriskt i omkretsled.

25 3. Sätt enligt krav 2, kännetecknat därav, att kanalerna (11) är förskjutna relativt varandra i rotoraxelns (2, 19) axiella led.

4. Sätt enligt krav 2 eller 3, kännetecknat därav, att man att man orienterar axeln (2, 19) så i gjutformen (1), att en utåtriktad kanal (11) mynnar i varje lob (9, 15).

5. Sätt enligt krav 2 eller 3, kännetecknat därav, att man förser rotoraxeln (2, 19)
30 med helixformade urtagningar (20), som har samma helixform som loberna (9, 15) och som skär var sin kanal (11).

6. Sätt enligt krav 4, kännetecknat därav, att man blandar materialet i den axiella borrningen (10).

7. Sätt enligt krav 1, kännetecknat därav, att man inför en statisk blandare 30 i den centrala kanalen 10 och inför en polymerbildande komponent genom blandarens öppning 33 och en andra polymerbildande komponent genom den andra öppningen 34.

Sammandrag

Uppfinningen avser ett sätt att framställa en polymerrotor för en skruvrotormaskin med en metallaxel (2) och helixformade, av mellanliggande spår åtskilda, lober, varvid man förser axeln (2) med en, endast i sin ena ände öppen, axiell borrning (10), förbinder den axiella borrningen (10) med axelns (2) mantelyta med minst en från borrningen (10) utåtriktad kanal (11), inför rotoraxeln (2) i en gjutform (1) med två på avstånd från varandra anordnade ändväggar (4, 5), som är försedda med centrala öppningar (6 respektive 7) för mottagning av rotoraxeln (2), vilka öppningar (4, 5) åtminstone i huvudsak tätande omsluter rotoraxeln (2), värmer gjutformen (1) inklusive axeln (2) till härdningstemperatur för polymeren, tillför polymerbildande material till gjutformen (1), håller gjutformens (1) mantelvägg (3) vid härdningstemperaturen tills polymeren har härdat och avlägsnar rotorn ur gjutformen (1).

Det utmärkande för sättet är att man anordnar den utåtriktade kanalen (11) så på axeln (2), att den befinner sig huvudsakligen i mitten av gjutformen (1), när axeln (2) är införd i denna och att man med ett övertryck av minst 1 bar pressar polymeren in i den axiella kanalen (10).

Figur 1

TENT COOPERATION TREA

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1313 ME	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE00/01998	International filing date (day/month/year) 16.10.2000	Priority date (day/month/year) 18.10.1999	
International Patent Classification (IPC) or national classification and IPC7 B29C 39/10, F04C 18/16			
Applicant SVENSKA ROTOR MASKINER AB et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 03.05.2001	Date of completion of this report 10.01.2002
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Mattias Arvidsson/MP Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01998

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☒ the international application as originally filed
- ☐ the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the claims:
 pages _____, as originally filed
 pages _____, as amended (together with any statement) under article 19
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the drawings:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01998

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-7</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-7</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

1. DE3903067 A1
2. WO9304811 A1
3. WO8909881 A1
4. SE 503730 C2

The cited documents represent the general state of the art. The invention defined in claims 1-7 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method of manufacturing a rotor for a helical screw machine. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-7 is novel and is considered to involve an inventive step. The invention is industrially applicable.

The demand must be filed directly with the competent International Preliminary Examining Authority, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ _____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only		
Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 1313 ME
International application No. PCT/SE00/01998	International filing date (day/month/year) 16-10-2000	(Earliest) Priority date (day/month/year) 18-10-1999
Title of invention METHOD FOR PRODUCING POLYMER ROTORS		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) SVENSKA ROTOR MASKINER AB P.O. Box 15085 S-104 65 STOCKHOLM, Sweden		Telephone No.: +46 8 466 45 00
		Facsimile No.: +46 8 466 45 01
		Teleprinter No.:
State (that is, country) of nationality: Sweden		State (that is, country) of residence: Sweden
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) TIMUSKA Karlis Valhallavägen 16 S-114 22 STOCKHOLM, Sweden		
State (that is, country) of nationality: Sweden		State (that is, country) of residence: Sweden
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) SUNDSTRÖM Mats Strandskatevägen 17 S-134 62 INGARÖ, Sweden		
State (that is, country) of nationality: Sweden		State (that is, country) of residence: Sweden
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

WIEDEMANN Bernd
SVENSKA ROTOR MASKINER AB
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+46 8 466 45 00

Facsimile No.:

+46 8 466 45 01

Teleprinter No.:

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION
Statement concerning amendments:*

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filed

the description

☐ as originally filed

☐ as amended under Article 34

the claims

☐ as originally filed

☐ as amended under Article 19 (together with any accompanying statement)

☐ as amended under Article 34

the drawings

☐ as originally filed

☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination:
☐ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input checked="" type="checkbox"/> other (<i>specify</i>): cheque |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

March 27, 2001

Bernd Wiedemann

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1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

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Demand received from IPEA on: